

Methods of Tests of Suspension Links for Trucks and Buses

FOREWORD

This Test Standard was proposed by The Automotive Research Association of India as guideline for testing of heavy commercial vehicles (HCV) axles and related safety critical components which includes Suspension Links.

Recently there have been changes in axle load norms by government of India in which the axle loads have been increased by around 10-15 percent. The effect of this on safety critical components was evaluated and the outcomes mentioned in this standard are derived from experiments conducted on actual vehicles and data and results derived thereof.

This Standard does not supersede any existing regulatory standard and is to be used purely as a guideline

METHODS OF TESTS OF SUSPENSION LINKS FOR TRUCKS AND BUSES

1 SCOPE

This standard specifies a laboratory test method for evaluating fatigue strength characteristics of Suspension Links of non-reactive bell-crank suspension used in Commercial Vehicles and Heavy Commercial Vehicles above 16 Ton Gross Vehicle Weight of haulage application.

2 TERMS AND DEFINITIONS

2.1 Rated Load

The load shared by the link when the vehicle is loaded to its gross vehicle weight.

2.2 'G'

G refers to the static load in N acting on each link viz. LH and RH.

e.g.) For an 11 Ton total load on LH and RH Links together, 1G corresponds to $(1 \times 11,000 \times 9.81) / 2 = 53955\text{N}$ on LH and RH link each.

3 GENERAL

Only fully processed new Links which are representative of Links to be used in intended vehicles shall be used for the test.

4 TESTS

4.1 Methodology

The test cycles and loads mentioned in the standard are derived based upon loads measured at wheel centre and further cascaded down to the links based on the kinematics. The standard "Methods of Tests of Axles for Trucks and Buses" is referred to arrive at test loads and cycles at the wheel, which are further cascaded to the links as mentioned further in the document

4.2 Equipment

The fatigue tests require servo hydraulic actuators connected to a high-pressure hydraulic system capable of providing the intended loads, (recommended 250kN Actuators capable at running up-to 5Hz Frequency). The hydraulic actuator should also be able to provide sufficient stroke required to achieve the intended loads.

The test setup should be able to provide the test load within $\pm 2\%$ of intended amplitude. Additional fixturing connected to a strong floor is required for providing sufficient reactions to the Suspension Link Mounting points as well as the actuators.

4.3 Test

4.3.1 Preparation and Test Setup

The link shall be clamped at both ends, one end to a loading actuator and other end to a rigid reaction. The assembly specifications shall be as specified by the vehicle manufacturer. The clamping hardware shall be tightened to the torque values specified and verified throughout the test. Fans may be used to cool the link bushings at appropriate locations.

4.3.2 Fatigue Test Load

The fatigue test shall be conducted in Load control.

Loading is to be done from 0 to Fl (Compressive)

Test Load (Fl) for link can be calculated as :

$$\text{Link Load (Fl)} = 2 * F_z * (X/2Y)$$

Where,

F_z = Wheel Vertical Static Load (1G) (in N)

X and Y are Rocker Lever arm lengths as shown below in Figure 1.

e.g. For an 11T axle with $X = 0.2$ and $Y = 0.15$,

$$\text{Link Load} = 2 * 53955 * (0.2 / 2 * 0.15) = 71.9\text{kN}$$

4.3.3 Test Cycles

Based upon the static operating payload of the Axle under test, the test engineer shall calculate the load and select cycles for testing the links from Table 1. The reference test schematic is given in figure 2

e.g. for an 11Ton axle, link is to be tested for 576000 cycles with load as mentioned in 4.3.2

The number of samples to be tested should be as agreed between the supplier and the purchaser. Minimum 3 samples for testing are recommended.

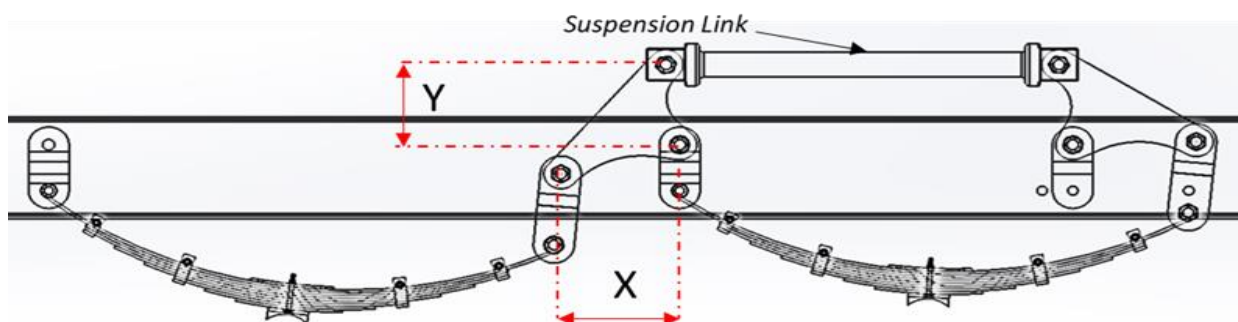


Figure 1 : Suspension Schematic

Axle Payload (tons)	Test Cycles
9.5	852000
10	743000
10.5	652000
11	576000
11.5	512000
12	457000
12.5	409000
13	369000
13.5	333000
14	302000
14.5	275000

Table 1: Test Cycles

4.3.4 Fatigue Failure Criteria

The Test sample is considered as failed in case of observation of any of the following

- a. Visible crack in the link after a Die Penetrant Test at end of prescribed test cycles.
- b. Permanent deformation of Link (Buckling or Bending) at the end of the test beyond the limit specified by the manufacturer

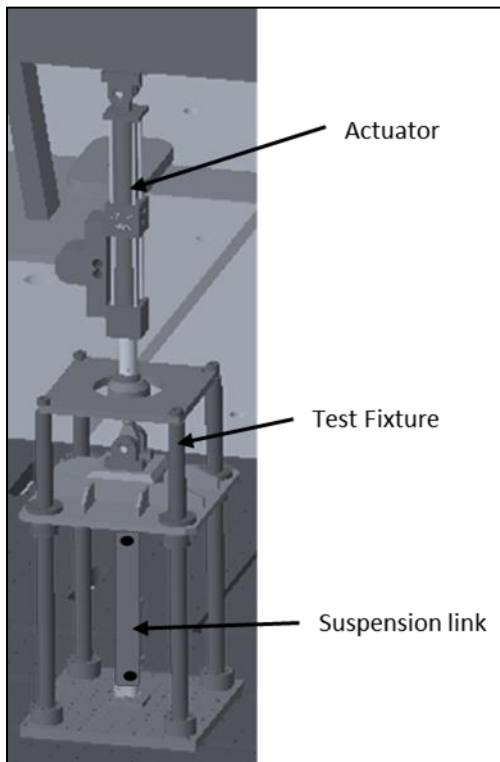


Figure 2 : Reference durability Test schematic